

FORM PTO 1390
(REV. 11-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371ATTORNEY DOCKET NUMBER
322-00066

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

10/019086

INTERNATIONAL APPLICATION NO.
PCT/AU00/00726INTERNATIONAL FILING DATE
27 June 2000PRIORITY DATE CLAIMED
28 June 1999TITLE OF INVENTION
METHOD OF PRODUCING A DIFFRACTIVE STRUCTURE IN SECURITY DOCUMENTSAPPLICANT(S) FOR DO/EO/US
Paul ZIENTEK

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☐ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☐ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821-1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information:
 - ☐ Applicant claims small entity status.
 - ☒ Supplement to Transmittal Letter.

U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 10/019086		INTERNATIONAL APPLICATION NO. PCT/AU00/00726		ATTORNEY'S DOCKET NUMBER 322-00066	
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21. <input checked="" type="checkbox"/> The following fees are submitted:				CALCULATIONS PTO USE ONLY	
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO.....				\$ 1,040.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO.....				\$ 890.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO				\$ 740.00	
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)..				\$ 710.00	
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims satisfied provisions of PCT Article 33(1)-(4).....				\$ 100.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$1,040.00	

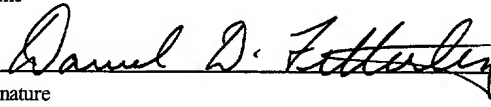
Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 C.F.R. 1.491(3)).				<input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30	+ 130.00
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CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	45 - 20 =	25	x \$ 18.00	+ 450.00	
Independent Claims	3 - 3 =		x \$ 84.00		
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$280.00	+ 280.00	
TOTAL OF ABOVE CALCULATIONS =				\$1,900.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				-	
SUBTOTAL =				\$1,900.00	
Processing fee of \$130.00 for furnishing the English Translation later than months from the earliest claimed priority date (37 C.F.R. 1.492(f)).				<input type="checkbox"/> 20 <input type="checkbox"/> 30	+
TOTAL NATIONAL FEE =				\$1,900.00	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). \$40.00 per property				+	
TOTAL FEES ENCLOSED =				\$1,900.00	
				Amount to be refunded:	
				Charged:	

a. <input checked="" type="checkbox"/>	A check in the amount of \$ <u>1,900.00</u> to cover the above fees is enclosed.
b. <input type="checkbox"/>	Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.
c. <input type="checkbox"/>	The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>01.2000</u> . A duplicate copy of this sheet is enclosed.
d. <input type="checkbox"/>	Fees are to be charged to a credit card. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO: ANDRUS, SCEALES, STARKE & SAWALL, LLP 100 East Wisconsin Avenue, Suite 1100 Milwaukee, Wisconsin 53202 Phone: (414) 271-7590 Fax: (414) 271-5770	<div style="text-align: center;"> </div> <div style="display: flex; justify-content: space-between;"> Signature Date <u>12/19/01</u> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> Daniel D. Fetterley 20,323 </div> <div style="display: flex; justify-content: space-between;"> Name Reg. No. </div>
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U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 10/019086	INTERNATIONAL APPLICATION NO. PCT/AU00/00726	ATTORNEY'S DOCKET NUMBER 322-00066
CERTIFICATE OF EXPRESS MAIL		
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Daniel D. Fetterley	20,323	
Name	Reg. No.	
	12/19/01	
Signature	Date	

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10/019086

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19 DEC 2001

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of)	Group Art Unit:
)	
PAUL ZIENTEK)	Examiner:
)	
Int'l. Appln. No. PCT/AU00/00726)	METHOD OF PRODUCING A
)	DIFFRACTIVE STRUCTURE IN SECURITY
Int'l. Filing Date: 27 June 2000)	DOCUMENTS

SUPPLEMENT TO TRANSMITTAL LETTER

Milwaukee, Wisconsin 53202
December 18, 2001

Box PCT Application
Commissioner for Patents
Washington, D.C. 20231

Sir:

Entry of this application into the National Phase in the United States is pursuant to 37 C.F.R. §1.494(c)/1.495(c). The papers include an English language specification and claims, and the drawing. The oath or declaration of the applicant is not included. The declaration will be forwarded promptly upon notification from the U.S. Patent and Trademark Office.

Respectfully submitted,

ANDRUS, SCEALES, STARKE & SAWALL, LLP

Daniel D. Fetterley
Daniel D. Fetterley (Reg. No. 20,323)

100 East Wisconsin Avenue, Suite 1100
Milwaukee, Wisconsin 53202
(414) 271-7590
Atty. Docket No.: 322-00066 (C.12053-122)

CERTIFICATE OF EXPRESS MAIL

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Daniel D. Fetterley	20,323
Name	Reg. No.
<i>Daniel D. Fetterley</i>	12/19/01
Signature	Date

2006040 9806 T001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of)	Group Art Unit:
)	
PAUL ZIENTEK)	Examiner:
)	
Int'l. Appln. No. PCT/AU00/00726)	METHOD OF PRODUCING A
)	DIFFRACTIVE STRUCTURE IN
Int'l. Filing Date: 27 June 2000)	SECURITY DOCUMENTS

PRELIMINARY AMENDMENT

Milwaukee, Wisconsin 53202
December 19, 2001

Box PCT Application
Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to computing the filing fee in this application, kindly amend the above identified application, as follows. The filing fee is to be computed on the amended claims.

In the Abstract:

A clean copy of the Abstract as published is attached. No changes to the Abstract have been made.

In the Specification:

Please add the following paragraph at page 1, between the title and the first line of text as follows:

CROSS REFERENCE TO RELATED APPLICATION

The present application is the U.S. national stage application of International Application PCT/AU00/00726, filed June 27, 2000, which international application was published on January 4, 2001 as International Publication WO 01/00418 in the English language. The International Application claims priority of Australian Patent Application No. PQ 1259, filed June 28, 1999.

SUMMARY OF THE INVENTION

Before the paragraph beginning at line 31 of page 1 insert the following:

BRIEF DESCRIPTION OF THE INVENTION

Before the paragraph beginning at line 24 of page 4 insert the following:

BRIEF DESCRIPTION OF THE DRAWING

Before the paragraph beginning at line 19 of page 5 insert the following:

DETAILED DESCRIPTION OF THE INVENTION

In the Claims:

Please amend claim 3 as follows:

3. (amended) A method of producing a security document or device according to claim 1, wherein the substrate includes a transparent plastics film.

Please amend claim 5 as follows:

5. (amended) A method of producing a security document or device according to claim 3, wherein the substrate further includes a transparent coating applied to the transparent plastics film, the optically diffractive structure being formed in the transparent coating.

Please amend claim 7 as follows:

7. (amended) A method of producing a security document or device according to claim 5, wherein the substrate further includes a reflective coating applied to

the transparent coating.

Please amend claim 9 as follows:

9. (amended) A method of producing a security document or device according to claim 7, wherein both the reflective coating and the transparent coating may be formed from material which is similarly resistant to physical degradation.

Please amend claim 10 as follows:

10. (amended) A method of producing a security document or device according to claim 5, wherein the substrate further includes a transparent layer applied to the transparent coating.

Please amend claim 12 as follows:

12. (amended) A method of producing a security document or device according to claim 10, wherein both the transparent layer and the transparent coating are formed from material which is similarly resistant to physical degradation.

Please amend claim 13 as follows:

13. (amended) A method of producing a security document or device according to claim 3, wherein the substrate further includes a reflective coating applied to the transparent plastics film, said optically diffractive structure being formed in the reflective coating.

Please amend claim 15 as follows:

15. (amended) A method of producing a security document or device according to claim 13, wherein the substrate further includes a transparent coating applied to the reflective coating.

Please amend claim 17 as follows:

17. (amended) A method of producing a security document or device according to claim 15, wherein both the reflective coating and the transparent coating are made of material which is similarly resistant to physical degradation.

Please amend claim 18 as follows:

18. (amended) A method of producing a security document or device according to claim 1, the method further comprising the step of:

applying at least one opacifying layer to the substrate, said at least one opacifying layer only partly covering a surface of the substrate to leave at least said optically diffractive device uncovered by said opacifying layer.

Please amend claim 20 as follows:

20. (amended) A method of producing a security document or device comprising a substrate and a detectable security device, the method comprising the step of:

exposing an area of the substrate on one surface to a light source which causes photo-polymerisation of the substrate which in turn produces a polarisation state or pattern.

Please cancel claim 21.

Please add the following claims:

22. (new) A method according to claim 19 further defined as exposing an area of the substrate on one surface to a photo-exposure process to produce a polarization pattern.

23. (new) A method of producing a security document or device according to claim 20 or 22 comprising the steps of irradiating an area of the substrate on one surface with patterned laser radiation to ablate selected portions of the surface.

24. (new) A method of producing a security document or device according

to claim 23, the method further comprising the step of placing a mask in the path of the laser radiation to create said patterned laser radiation.

25. (new) A method of producing a security document or device according to either one of claims 20 or 22, wherein the substrate includes a transparent plastics film.

26. (new) A method of producing a security document or device according to claim 25, wherein the substrate further includes a transparent coating applied to the transparent plastics film.

27. (new) A method of producing a security document or device according to claim 26, wherein the substrate further includes a reflective coating applied to the transparent coating.

28. (new) A method of producing a security document or device according to claim 27, wherein both the reflective coating and the transparent coating may be formed from material which is similarly resistant to physical degradation.

29. (new) A method of producing a security document or device according to claim 26, wherein the substrate further includes a transparent layer applied to the coating.

30. (new) A method of producing a security document or device according to claim 29, wherein both the transparent layer and the transparent coating are formed from material which is similarly resistant to physical degradation.

31. (new) A method of producing a security document or device according to claim 25, wherein the substrate further includes a reflective coating applied to the transparent plastics film.

32. (new) A method of producing a security document or device according to claim 31, wherein the substrate further includes a transparent coating applied to the reflective coating.

33. (new) A method of producing a security document or device according to claim 32, wherein both the reflective coating and the transparent coating are made of material which is similarly resistant to physical degradation.

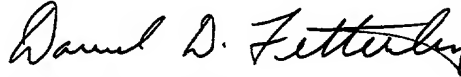
34. (new) A method of producing a security document or device according to either of claims 20 or 22, the method further comprising the step of applying at least one opacifying layer to the substrate, said at least one opacifying layer only partly covering the surface of the substrate.

20060404 090657001

Entry of this amendment is respectfully requested.

Respectfully submitted,

ANDRUS, SCEALES, STARKE & SAWALL, LLP

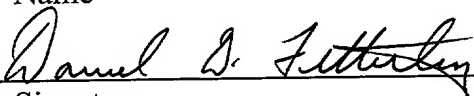


Daniel D. Fetterley
(Reg. No. 20,323)

100 East Wisconsin Avenue, Suite 1100
Milwaukee, Wisconsin 53202
(414) 271-7590
Atty. Docket No. 322-00066 (C.12053-122)

CERTIFICATE OF EXPRESS MAIL

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<u>Daniel D. Fetterley</u>	<u>20,323</u>
Name	Reg. No.
<u></u>	<u>12/19/01</u>
Signature	Date

Attorney Docket No. 322-00066

In the Specification:

Please add the following paragraph at page 1, between the title and the first line of text as follows:

CROSS REFERENCE TO RELATED APPLICATION

The present application is the U.S. national stage application of International Application PCT/AU00/00726, filed June 27, 2000, which international application was published on January 4, 2001 as International Publication WO 01/00418 in the English language. The International Application claims priority of Australian Patent Application No. PQ 1259, filed June 28, 1999.

SUMMARY OF THE INVENTION

Before the paragraph beginning at line 31 of page 1 insert the following:

BRIEF DESCRIPTION OF THE INVENTION

Before the paragraph beginning at line 24 of page 4 insert the following:

BRIEF DESCRIPTION OF THE DRAWING

Before the paragraph beginning at line 19 of page 5 insert the following:

DETAILED DESCRIPTION OF THE INVENTION

In the Claims:

Claim 3 has been amended as follows:

3. (amended) A method of producing a security document or device according to claim 1 ~~either one of claims 1 or 2~~, wherein the substrate includes a transparent plastics film.

Claim 5 has been amended as follows:

5. (amended) A method of producing a security document or device according to claim 3~~either one of claims 3 or 4~~, wherein the substrate further includes a transparent coating applied to the transparent plastics film, the optically diffractive structure being formed in the transparent coating.

Claim 7 has been amended as follows:

7. (amended) A method of producing a security document or device according to claim 5~~either one of claims 5 or 6~~, wherein the substrate further includes a reflective coating applied to the transparent coating.

Claim 9 has been amended as follows:

9. (amended) A method of producing a security document or device according to claim 7~~either one of claims 7 or 8~~, wherein both the reflective coating and the transparent coating may be formed from material which is similarly resistant to physical degradation.

Claim 10 has been amended as follows:

10. (amended) A method of producing a security document or device according to claim 5~~either one of claims 5 or 6~~, wherein the substrate further includes a transparent layer applied to the transparent coating.

Claim 12 has been amended as follows:

12. (amended) A method of producing a security document or device according to claim 10~~either one of claims 10 or 11~~, wherein both the transparent layer and the transparent coating are formed from material which is similarly resistant to physical degradation.

Claim 13 has been amended as follows:

13. (amended) A method of producing a security document or device according to claim 3~~either one of claims 3 or 4~~, wherein the substrate further includes a

reflective coating applied to the transparent plastics film, said optically diffractive structure being formed in the reflective coating.

Claim 15 has been amended as follows:

15. (amended) A method of producing a security document or device according to claim 13 ~~either one of claims 13 or 14~~, wherein the substrate further includes a transparent coating applied to the reflective coating.

Claim 17 has been amended as follows:

17. (amended) A method of producing a security document or device according to claim 15 ~~either one of claims 15 or 16~~, wherein both the reflective coating and the transparent coating are made of material which is similarly resistant to physical degradation.

Claim 18 has been amended as follows:

18. (amended) A method of producing a security document or device according to claim 1 ~~any one of the preceding claims~~, the method further comprising the step of:

applying at least one opacifying layer to the substrate, said at least one opacifying layer only partly covering a surface of the substrate to leave at least said optically diffractive device uncovered by said opacifying layer.

Claim 20 has been amended as follows:

20. (amended) ~~In an alternative form, the invention provides a~~ A method of producing a security document or device comprising a substrate and a detectable security device, the method comprising the step of:

exposing an area of the substrate on one surface to a light source which causes photo-polymerisation of the substrate which in turn produces a polarisation state or pattern.

Claim 21 has been canceled.

METHOD OF PRODUCING A DIFFRACTIVE STRUCTURE IN SECURITY DOCUMENTS

5 The present invention relates generally to a method of producing a security document or device, and in particular to security documents or devices which include an optically diffractive structure, or other visible or detectable effect such as a defraction grating or like device, or a polarisation pattern. The invention is applicable to the production of banknotes, and it will be convenient
10 to hereinafter describe the invention in relation to that exemplary application. It is to be appreciated, however, that the invention is not to be limited to that application.

The practice of applying defraction gratings and like optically detectable diffractive and other structures to security documents and devices, such as credit
15 cards, bank notes and cheques, has become widely adopted. Currently, defraction gratings and other structures are produced in multi-layer thin films supported on thin carrier structures. The structures are then transferred from the thin film carrier substrate to the security document or device, typically by using a hot-stamping process. Reflective optical defraction devices conventionally
20 contain an ultra-thin vacuum metallised reflective layer, usually aluminium, adjacent to the diffractive structure within the multi-layer structure.

A number of disadvantages are associated with the production and application of optically diffractive and other devices in this manner. Firstly, the complex and highly specialised process required to produce the multi-layer
25 optically diffractive device structure, which may contain at least four and frequently more layers, is costly. Secondly, an extra process step is required to transfer the optically diffractive device from the carrier substrate onto the security document or device. Thirdly, the resistance of the optically diffractive device as a whole to physical wear and tear and chemical attack is poor due to
30 the weakness of the vacuum metallised reflective layer.

An aim of the present invention is to ameliorate or overcome one or more of the disadvantages of known methods for producing security documents or

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devices including optically diffractive devices or other detectable effects such as polarisation patterns.

The present invention provides a method of producing a security document or device comprising a substrate and a detectable security device, the method comprising the step of:

exposing an area of the substrate on one surface to a photo-exposure process to generate a changed state in the surface of the substrate to produce a detectable effect in said surface, such as a polarisation pattern or an optically diffractive structure.

The present invention also provides a method of producing a security document or device comprising a substrate and a detectable security device, the method comprising the step of:

irradiating an area of the substrate on one surface with patterned laser radiation to ablate selected portions of the surface and thereby form an optically diffractive structure in said one surface.

In an alternative form, the invention provides a method of producing a security document or device comprising a substrate and a detectable security device, the method comprising the step of:

exposing an area of the substrate on one surface to a light source which causes photo-polymerisation of the substrate which in turn produces a polarisation state or pattern.

The present invention significantly simplifies the multi-layered structure of a security device when incorporated into the security document or device. The application of an optically diffractive or polarisation or like device may be easily integrated into the process of manufacture of the security document or device. Moreover, in those cases in which reflective optically diffractive or polarisation devices are used, it is possible to eliminate the use of a brittle metallised coating.

The method of producing a security document or device may further comprise the step of placing a mask in the path of the laser radiation to create said patterned laser radiation.

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Conveniently, the substrate may be formed from a transparent plastics film. The transparent plastics film may be formed from polymeric material. The substrate may also be formed from paper, paper/polymer composites, coated paper and other non-transparent substrates in those cases where reflective diffraction devices were used.

In one embodiment, the substrate may further comprise a transparent coating applied to the transparent plastics film, the optically diffractive structure being formed in the transparent coating. The transparent coating may be formed from a polymeric material.

In one embodiment, the substrate may further comprise a reflective coating applied to the transparent coating. The reflective coating may be formed from polymeric material and may contain metallic pigment particles.

Conveniently, both the reflective coating and the transparent coating may be formed from material which is similarly resistant to physical degradation, such as by chemical attack.

In another embodiment, the substrate may further comprise a transparent layer applied to the transparent coating. The transparent layer may be formed from polymeric material. Conveniently, both the transparent layer and the transparent coating may be formed from material which is similarly resistant to physical degradation, for example by chemical means.

In a still further embodiment, this substrate may further comprise a reflective coating applied to the transparent plastics film, said optically diffractive structure being formed in the reflective coating. The reflective coating may be formed from polymeric material and may contain metallic pigment particles.

The substrate may further comprise a transparent coating applied to the reflective coating. The transparent coating may be formed from a polymeric material. The substrate may also be formed from paper, paper/polymer composites, coated paper and other non-transparent substrates in those cases where reflective diffractive structures are used. Both the reflective coating and

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the transparent coating may be made of material which is similarly resistant to physical degradation, for example, by chemical means.

The method of producing a security document or device may further comprise the step of applying at least one opacifying layer to the substrate, said
5 at least one opacifying layer only partly covering a surface of the substrate to leave at least said optically diffractive device uncovered by said opacifying layer.

The method of the invention is alternatively able to be used to create other types of security devices that do not use the phenomenon of diffraction as
10 the basis for the visible optical pattern or effect that imparts security to the device and therefore to the documents that contain the device.

For example, it is possible to create an image in the substrate, or in the coating layers, of a security document that is only visible in polarised light.

In such a case, the image is not visible in normal un-polarised lighting
15 conditions, and only becomes visible when viewed in certain polarised lighting conditions. The polarisation state of the lighting conditions under which the image may be viewed can be either linear or circular polarisation. It is further possible to create the means for checking the device (ie. by observing its visible presence) under polarised lighting conditions on the security document itself by
20 providing the means for the polarised lighting conditions on the document itself. Such a device may be either a single multiple layer device, of which one of the layers may or may not be the substrate layer and the remaining layers would be coating layers applied in-line during the forming or printing process.

The following description refers in more detail to the various features of
25 the method for producing a security document or device according to the present invention. To facilitate an understanding of the invention, reference is made in the description to the accompanying drawings where the invention is illustrated in a number of preferred embodiments. It is to be understood, however, that the invention is not limited to the preferred embodiments as illustrated in the
30 drawings.

In the drawings:

- 5 -

Figure 1 is a schematic diagram illustrating steps involved in the method for producing a first embodiment of a security document including a reflective diffractive structure according to the present invention;

Figure 2 is a schematic diagram illustrating steps involved in the production of a second embodiment of a security document including a reflective diffractive structure according to the present invention;

Figure 3 is a schematic diagram illustrating steps involved in the production of a third embodiment of a security document including a reflective diffractive structure according to the present invention;

Figure 4 is a schematic diagram illustrating steps involved in the production of a first embodiment of a security document including a transmission diffractive structure according to the present invention;

Figure 5 is a schematic diagram illustrating steps involved in the production of a second embodiment of a security document including a transmission diffractive structure according to the present invention; and

Figure 6 is a schematic diagram illustrating steps involved in the production of a third embodiment of a security document including a transmission diffractive structure according to the present invention.

Referring now to Figure 1, there is shown a transparent plastics film 2 formed from polymeric material, used in the manufacture of polymer banknotes.

The substrate 2 may be made from at least one biaxially oriented polymeric film. The substrate may comprise a single layer of film of polymeric material, or, alternatively, a laminate of two or more layers of transparent biaxially oriented polymeric film. The substrate 2 is seen in cross section in Figure 1.

Whilst the invention will be described with reference to Figures 1 to 6 in relation to the production of polymer banknotes, it is to be appreciated that the invention may also be used in the production of credit cards, cheques and other security documents or devices, and that the function and properties of the substrate in those security documents or devices may vary.

In this example, a defraction grating or other optically diffractive device is formed on one surface 3 of the substrate 2 by eradiating an area of that

- 6 -

surface with pattern laser radiation. The patterning of the laser radiation incident on the one surface 3 of the substrate 2, may result from the placement of a mask in the path of the laser radiation. The mask 4 may have apertures 5 formed therein such that in those areas where the laser radiation passes through the mask, the light interacts with the surface layer of the substrate 2 in which the defraction grating is to be created, causing material to be ablated or otherwise removed to an appropriate depth in the surface layer of the substrate 2 and resulting in a three dimensional optically diffractive structure 6.

A reflective coating 7 is then applied to the obladed surface of the substrate 2. The reflective coating 7 may be a coated polymer layer, containing, for example, metallic pigment particles, or reflective particles, to perform a reflective function. The reflective layer 7 may be applied by conventional printing methods, and may fill the three dimensional structures formed by the laser oblotion of the surface 3 of the substrate 2. The coated polymer layer 7 acts as a binding matrix to hold the reflective particles, and provides the strength and flexibility required for the reflective layer to resist physical wear and tear, while the pigment particles may be formed from a material which is resistant to chemical attack.

When incident light 8 from a light source 9 is reflected to a user 10 the reflected light 11 is observed as being diffracted.

Opacifying layers 12 and 13 may be applied to one or more opposing faces of the coated substrate. The opacifying layers 12 and 13 may comprise any one or more of a variety of opacifying inks which can be used in the printing of banknotes or other security documents. For example, the layers of opacifying ink may comprise pigmented coatings comprising a pigment, such as titanium dioxide, dispersed within a binder or carrier of heat activated cross linkable polymeric material. Alternatively, the coated substrate may be sandwiched between opacifying layers of paper.

In order to view the diffractive effect caused by the optically diffractive device, at least a first region of a surface of the substrate 2 may be left uncovered by the opacifying layers.

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Figure 2 illustrates a first variation of the method for producing a security document or device according to the invention. In this figure, the substrate 2 is initially coated with a transparent coating 20. The transparent coating 20 may be formed from a polymeric material.

5 Laser radiation, patterned by a mask 4, is then used to ablate selected portions of transparent coating 20, and to form therein a three dimensional optically diffractive structure 21. A reflective coating, identical to the reflective coating 7 applied to the substrate 2 in Figure 1, is then applied by conventional printing methods to the transparent coating 20. Both the transparent coating 20
10 and the reflective coating 22 may be formed from coated polymer material or other like material which is similarly resistant to physical degradation, such as by chemical attack. In this way, a counterfeiter wishing to recover the optically diffractive device by desolving or chemically etching the reflective layer 22, would also cause the desolving or chemical etching of the transparent coating 20
15 and the optically diffractive structure formed therein.

Once again, opacifying coatings may be applied to one or both surfaces of the coated substrate structure 2, 20, 22.

A second variant of the method illustrated in Figure 1 is shown in Figure 3. In this figure, one surface of the substrate 2 is firstly coated with a reflective
20 coating 25, identical to the reflective layer 7 in Figure 1. Laser radiation is then patterned by the mask 4 to ablate material from the reflective coating 25 to thus form a three dimensional optically diffractive structure 26 in the reflective coating 25.

Subsequently, a transparent coating 27 is applied to the reflective coating
25 25. The transparent coating 27 may fill the three dimensional structure formed in the reflective layer 25. Once again, the reflective coating 25 and the transparent coating 27 may be made from material which is similarly resistant to chemical attack or other physical degradation, in order to prevent the optically diffractive structure 26 from being recovered by a counterfeiter.

30 Whilst Figures 1 to 3 illustrate examples of a method of producing a security document including a reflective diffractive device, Figures 4 to 6

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provide examples of a method of producing a security document including a transmission diffractive device. In Figure 4, one surface of the transparent polymeric film 2 is ablated by laser radiation passing through a mask 4, to form therein the same optically diffractive device 6 illustrated in Figure 1. However, 5 in this example, no reflective layer is subsequently applied to the surface of the substrate 2, so that a defraction effect is observed by the user 10 when light 30 from the light source 9 is transmitted through the substrate 2.

As in previous examples, opacifying coatings 31 to 34 may be applied to opposing surfaces of the substrate 2, leaving uncovered regions or zones 35 and 10 36 to enable the light 30 transmitted through the optically diffractive structure formed in the substrate 2.

In a first variation of this method, as illustrated in Figure 5, an optically diffractive device 6 is once again ablated into a surface of the transparent substrate film 2. Subsequently, a clear coating layer 40 of different refractive 15 index to the substrate film 2, is applied to the surface of the substrate 2. The transparent coating 40, as in previous examples, fills the three dimensional diffractive device 6, and prevents wearing of optically diffractive structure 6. The defraction effect produced by the structure 6 may once again be observed in light transmitted through the substrate and transparent coating.

20 In method 6, there is illustrated a second variation of the method for producing a security document including a transmission diffractive structure. In this figure, the transparent plastics substrate 2 is firstly coated with a clear coating 45 formed from a transparent polymeric material. A diffractive structure 46 is ablated into the clear coating 45 by means of incident patterned 25 laser radiation. A transparent layer 47 is then coated onto the transparent coating 45 filling the diffractive structure 46 formed therein. The transparent layer 47 and the transparent coating 45 are formed from materials having different refractive indexes, in order that a defraction effect may be observed when light is transmitted through the security device. Where the method does 30 not include transparent layer 47, the resulting document still functions as described above.

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The device described in this example/embodiment of the invention relies on the ability to pattern the polarisation state of the material that constitutes one of the layers of the device. This applies to the layer which contains the viewable image and also in the case of the layer(s) which would act as the polarisation filters for creating the polarised lighting conditions under which the image of the device can be viewed. Specifically, a UV photo-polymerisable material is used in the layer(s) where the polarisation state is patterned. A polarisation state is created by aligning the molecular structure of the material, which is achieved by exposing the material to a UV light source such as a laser or a conventional UV lamp. The photo-exposure creates a molecular state with a specific polarisation state that is "fixed" by the photo-polymerisation process. The patterning of the polarisation states is achieved by masking the UV light source to create the different polarisation states spatially across the device.

Various specific configurations of the equipment required to do this are possible. For example the light source may be a UV laser or a conventional UV lamp. Similarly a single or multiple step masking process may be used to create the various polarisation states required in the different spatial regions on across the device.

In this embodiment of the invention, the appropriate layers are applied during the substrate opacification process. During this process, the layer(s) which require polarisation are exposed to the UV laser or other UV light source shortly after they have been applied in order to "fix" them into the appropriate polarisation state.

The process of creating the desired polarisation state in the substrate or coating is similar to the above described process of creating a diffractive structure with the exception that conventional UV lamps may replace the UV laser source referred to in that description.

It will be appreciated that the methods described in Figures 1 to 6 may be easily integrated into the normal multi-step process during which a substrate is coated or otherwise treated, to produce a security document or device, the laser process merely being integrated into this multi-step process. This method, and

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- the security document or device including an optically diffractive device produced by this method, eliminate the need for a separate manufacturing process to produce an optically diffractive device transfer foil and the separate hot stamp foil transfer process to transfer that diffractive device transfer foil to
- 5 the product.

The method according to the present invention is capable of producing either reflective or transmissive optically diffractive devices, such as reflective optically variable devices or a transmission hologram.

- Finally, it should be appreciated that modifications and/or alterations
- 10 may be made to the method and security document or device without departing from the ambit of the present invention.

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CLAIMS

1. A method of producing a security document or device comprising a substrate and an optically diffractive device, the method comprising the step of:
irradiating an area of the substrate on one surface with patterned laser radiation to ablate selected portions of the surface and thereby form an optically diffractive structure in said one surface.
- 5
2. A method of producing a security document or device according to claim 1, the method further comprising the step of:
placing a mask in the path of the laser radiation to create said patterned laser radiation.
3. A method of producing a security document or device according to either one of claims 1 or 2, wherein the substrate includes a transparent plastics film.
4. A method of producing a security document or device according to claim 3, wherein the transparent plastics film is formed from polymeric material.
5. A method of producing a security document or device according to either one of claims 3 or 4, wherein the substrate further includes a transparent coating applied to the transparent plastics film, the optically diffractive structure being formed in the transparent coating.
6. A method of producing a security document or device according to claim 5, wherein the transparent coating is formed from polymeric material.
7. A method of producing a security document or device according to either one of claims 5 or 6, wherein the substrate further includes a reflective coating applied to the transparent coating.

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8. A method of producing a security document or device according to claim 7, wherein the reflective coating is formed from polymeric material containing metallic pigment particles.

9. A method of producing a security document or device according to either one of claims 7 or 8, wherein both the reflective coating and the transparent coating may be formed from material which is similarly resistant to physical degradation.

10. A method of producing a security document or device according to either one of claims 5 or 6, wherein the substrate further includes a transparent layer applied to the transparent coating.

11. A method of producing a security document or device according to claim 10, wherein the transparent layer is formed from polymeric material.

12. A method of producing a security document or device according to either one of claims 10 or 11, wherein both the transparent layer and the transparent coating are formed from material which is similarly resistant to physical degradation.

13. A method of producing a security document or device according to either one of claims 3 or 4, wherein the substrate further includes a reflective coating applied to the transparent plastics film, said optically diffractive structure being formed in the reflective coating.

14. A method of producing a security document or device according to claim 13, wherein the reflective coating is formed from polymeric material containing metallic pigment particles.

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15. A method of producing a security document or device according to either one of claims 13 or 14, wherein the substrate further includes a transparent coating applied to the reflective coating.

16. A method of producing a security document or device according to claim 15, wherein the transparent coating is formed from a polymeric material.

17. A method of producing a security document or device according to either one of claims 15 or 16, wherein both the reflective coating and the transparent coating are made of material which is similarly resistant to physical degradation.

18. A method of producing a security document or device according to any one of the preceding claims, the method further comprising the step of :

applying at least one opacifying layer to the substrate, said at least one opacifying layer only partly covering a surface of the substrate to leave at least said optically diffractive device uncovered by said opacifying layer.

19. A method of producing a security document or device comprising a substrate and a detectable security device, the method comprising the step of:

exposing an area of the substrate on one surface to a photo-exposure process to generate a changed state in the surface of the substrate to produce a detectable effect in said surface, such as a polarisation pattern or an optically diffractive structure.

20. In an alternative form, the invention provides a method of producing a security document or device comprising a substrate and a detectable security device, the method comprising the step of:

exposing an area of the substrate on one surface to a light source which causes photo-polymerisation of the substrate which in turn produces a polarisation state or pattern.

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21. The method of claim 19 or 20 further including one or more of the steps or features as defined in any one of claims 2 to 18 when modified to refer to detectable security devices other than diffraction gratings, such as polarisation patterns.

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ABSTRACT OF THE DISCLOSURE

A method of producing a security document or device comprising a substrate and an optically diffractive device, the method comprising the step of: irradiating an area of the substrate (2) on one surface with patterned laser radiation to ablate selected portions of the surface and thereby form an optically diffractive structure in said one surface. A method
5 of producing a security document or device comprising a substrate and an optically variable device, such as a means for creating polarization patterns, the method comprising the step of: exposing an area of the substrate on one surface to a light source which causes photo-polymerization of the substrate which in turn produces a polarization state or pattern.

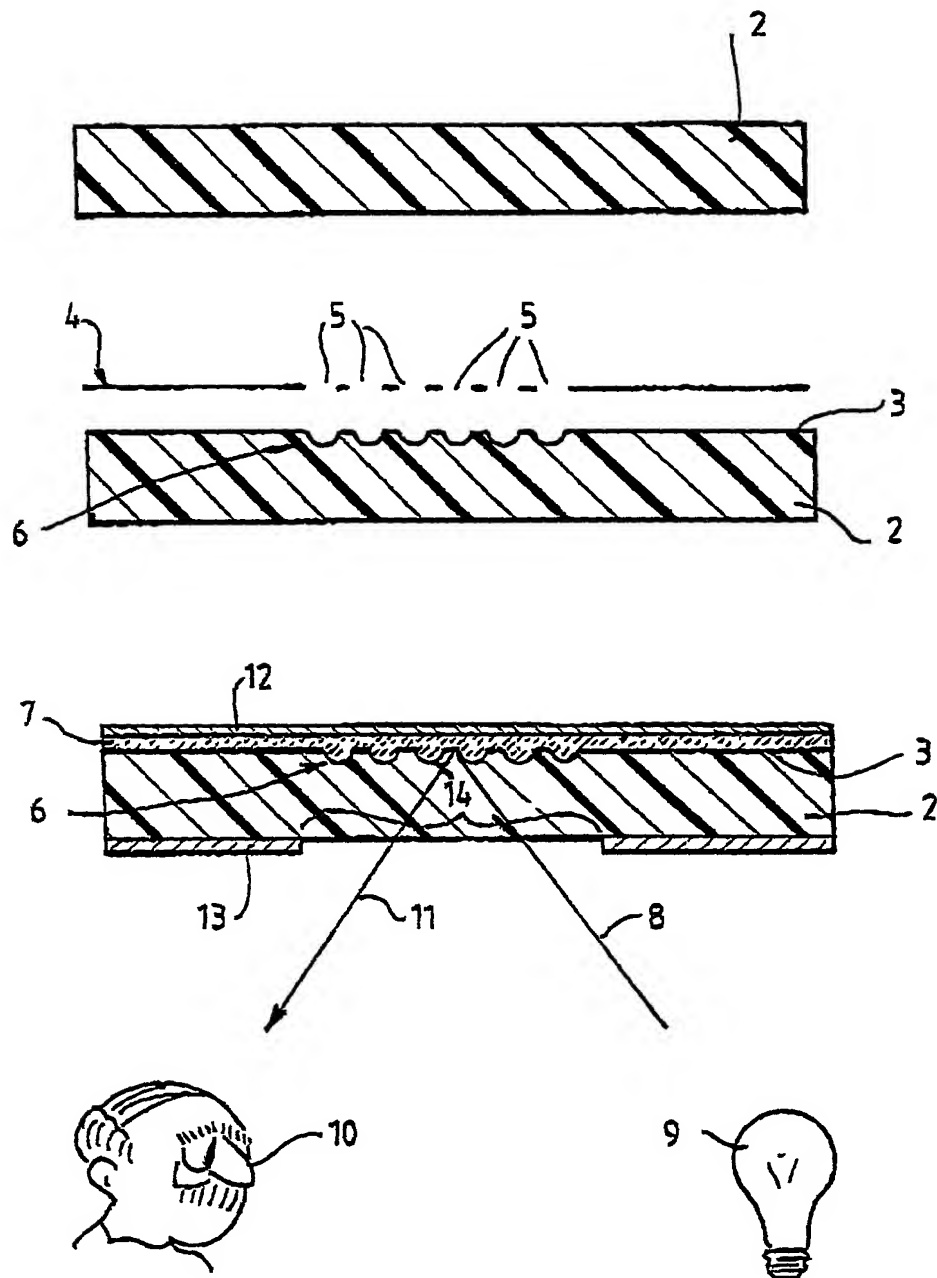
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FIG. 1.

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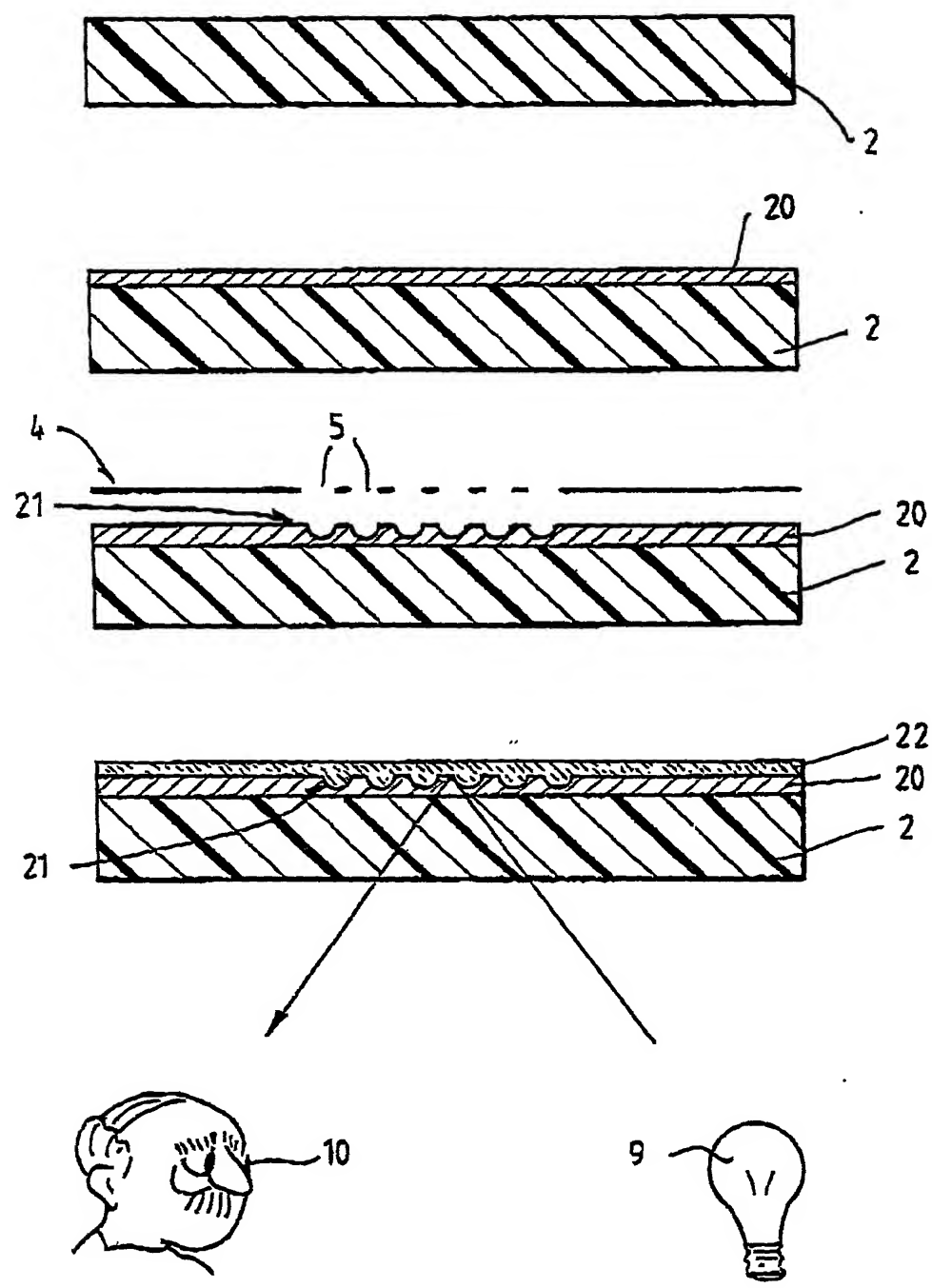


FIG. 2.

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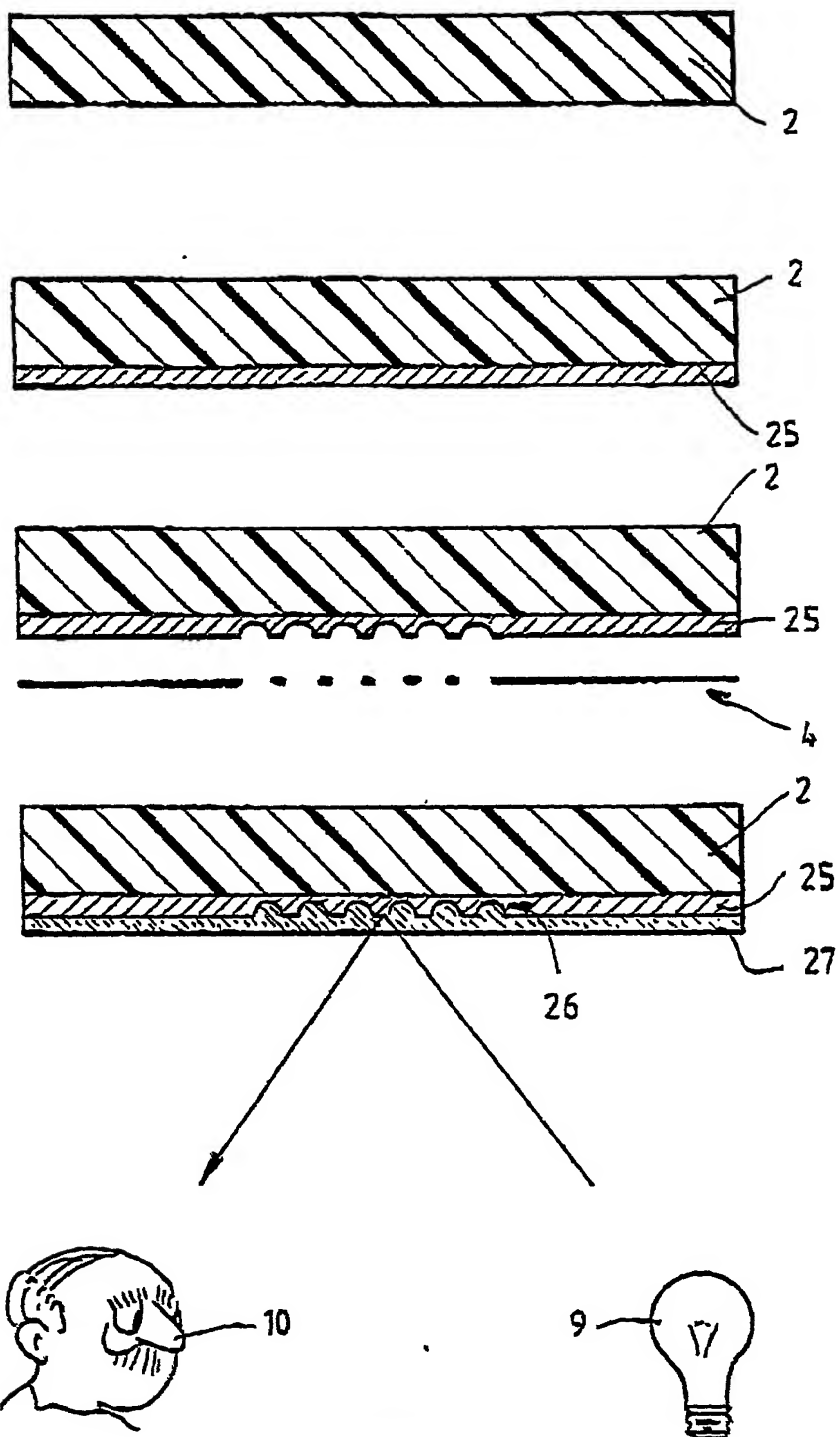


FIG. 3.

Substitute Sheet
(Rule 26) RO/AU

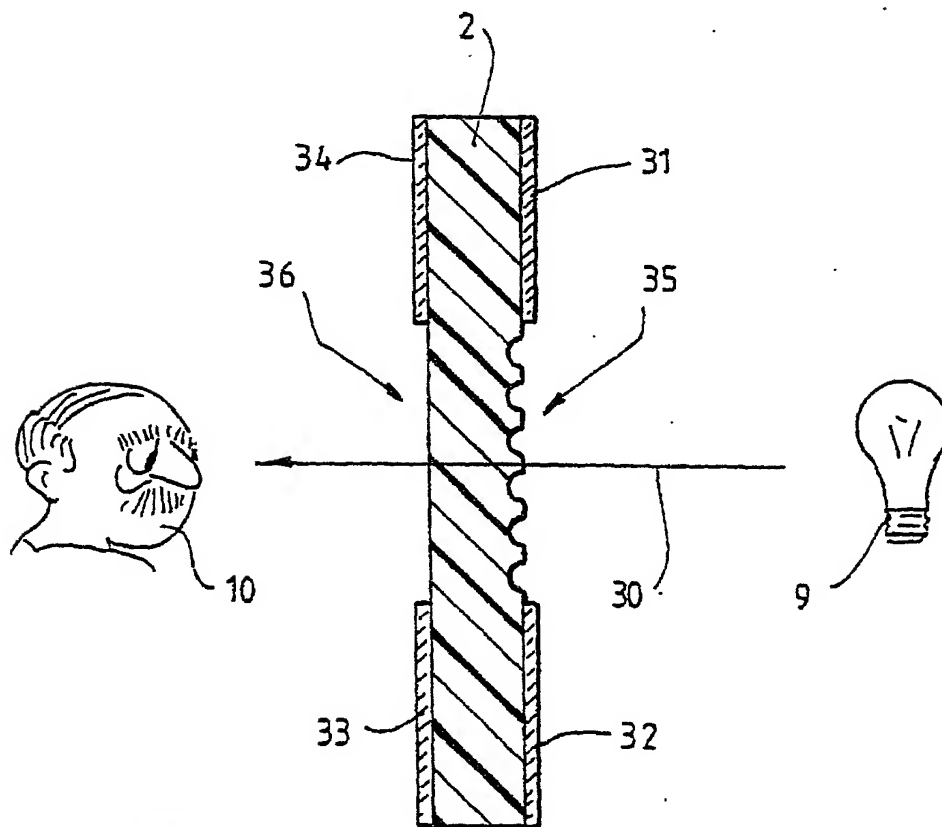
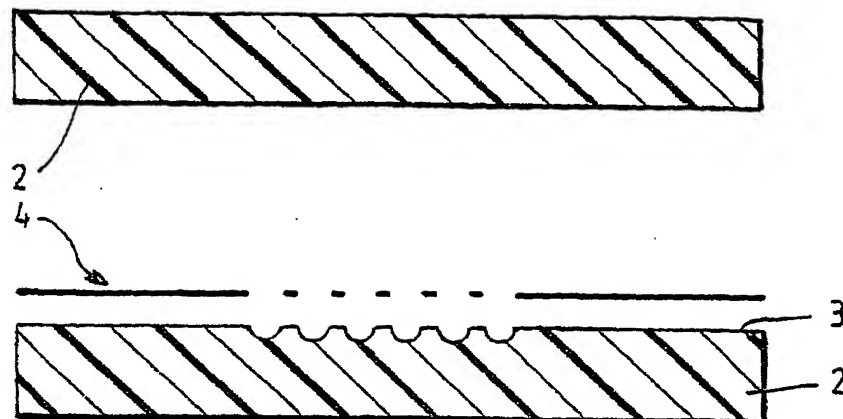


FIG. 4.

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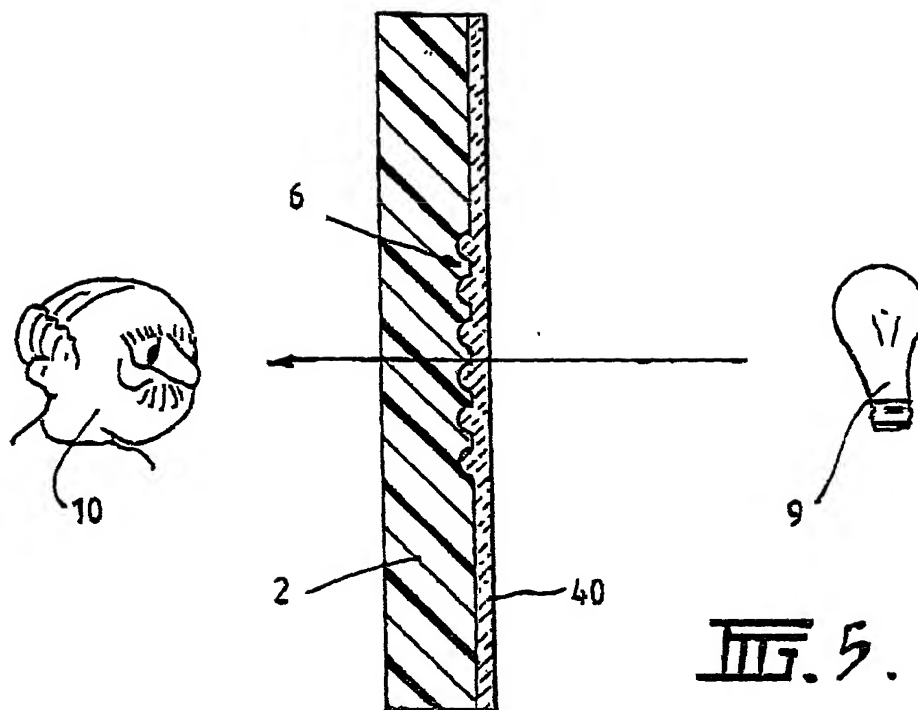
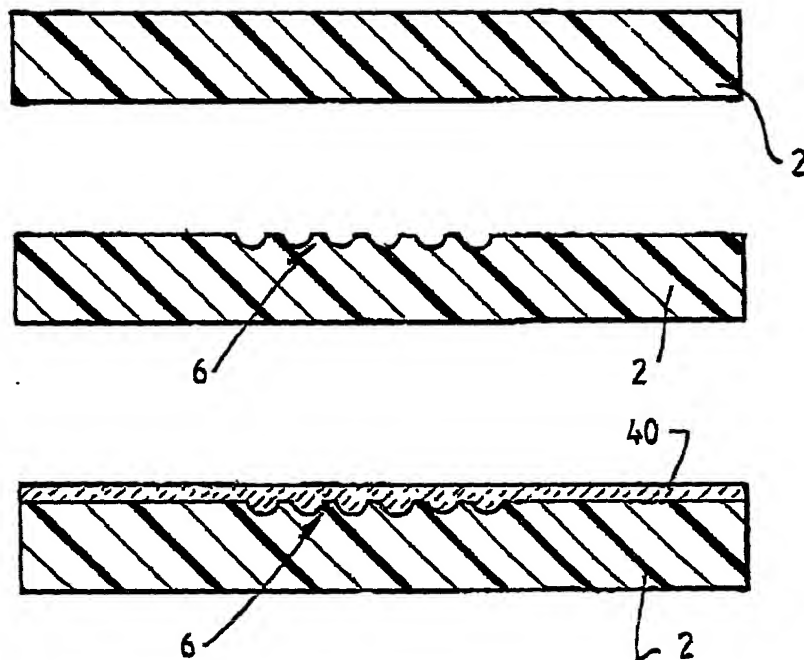


FIG. 5.

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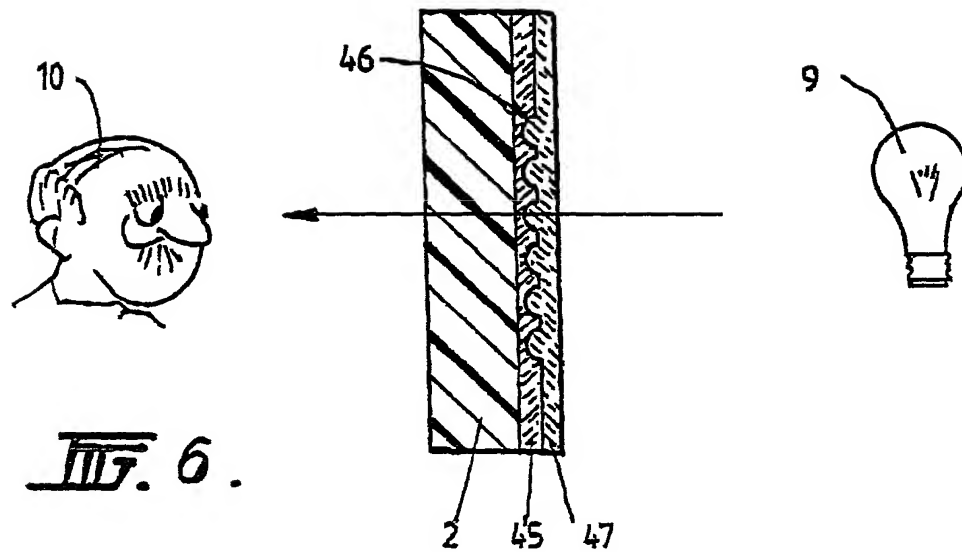
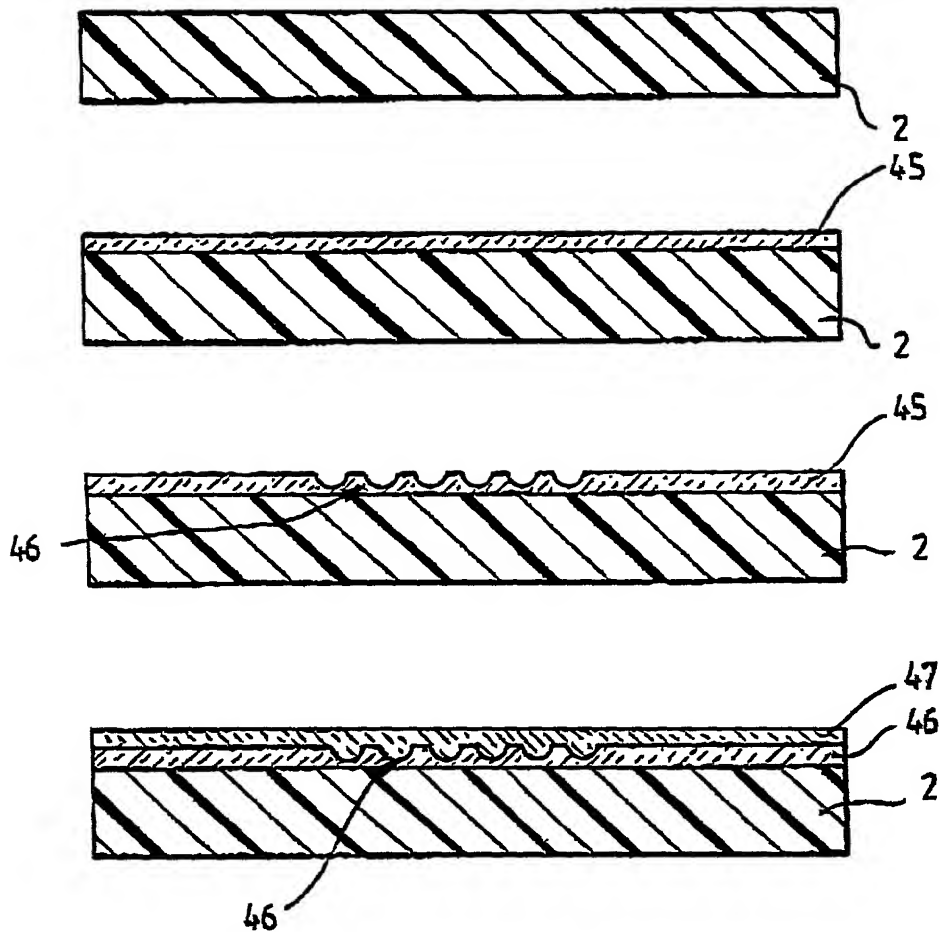


FIG. 6.

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PTO/SB/01 (8/96) DECLARATION Declaration OR Declaration <input type="checkbox"/> Submitted with X Submitted after Initial Filing Initial Filing (surcharge 37 CFR 1.16(3)) required)	<table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 60%;">Attorney Docket Number</td><td>322-00066</td></tr><tr><td>First Named Inventor</td><td>Zientek, Paul</td></tr><tr><td colspan="2" style="text-align: center;">COMPLETE IF KNOWN</td></tr><tr><td>Application Number</td><td></td></tr><tr><td>Filing Date</td><td></td></tr><tr><td>Group Art Unit</td><td></td></tr><tr><td>Examiner Name</td><td></td></tr></table>	Attorney Docket Number	322-0006 6	First Named Inventor	Zientek, Paul	COMPLETE IF KNOWN		Application Number		Filing Date		Group Art Unit		Examiner Name	
Attorney Docket Number	322-0006 6														
First Named Inventor	Zientek, Paul														
COMPLETE IF KNOWN															
Application Number															
Filing Date															
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As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Method of producing a diffractive structure in security documents

(Title of the Invention)

the specification of which
☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) as United States Application Number or PCT

International Number PCT/AU00/00726 and was amended on
(if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designed at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Copy Attached?	
				YES	NO
PQ1259	Australia	28 June 1999	<input type="checkbox"/>	<input type="checkbox"/>	X
PCT/AU00/00726	PCT	27 June 2000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s), or §365(c) of any PCT international application designated the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States of PCT International application in the manner provided by the first paragraph of Title 35, United States Code §112. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

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As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any]) Paul Family Name or Surname Zientek

Inventor's Signature

Date 8 January, 2002

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